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Study of body condition scores and its relationship with various body measurements in Murrah buffalo

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Abstract
A total of 30 Murrah buffaloes of 1st to 5th parity Were selected and distributed into three different groups based on their pre-calving BCS (before 2 months of expected date of calving) namely BCS group L (<3.0), BCS group M (3-4) and BCS group H (4.0 and above). Parameters observed during the study period were body condition scores, body measurements (Height at wither, Height at chest from ground, Chest girth, Abdominal girth).
Results of this study revealed that body condition score, body measurements were significantly ($P<0.05$) higher in BCS group H as compared to BCS group L and M throughout the study period (2 months precalving and 6 months postcalving).
The results of this study showed that the body measurement (HW, HC, AG, HG) differs significantly among the different BCS groups i.e. highest value exhibited by the animals in BCS group H as compared to group M and L in terms of AG, HG and HW while the HC found to be highest in the group L this might happen due the less fat deposition in the animals of BCS group L. Results of correlation study showed a positive relationship between BCS and AG, HG and HW and a negative correlation with HC.

Keywords: BCS, Murrah buffalo, body measurements

Introduction
The dairy animals uses their body reserves as an energy source in early lactation to support high milk yield that is why adequate amounts of nutrients must be stored in body tissues during later stages of lactation. In early lactation the energy intake does not keep pace with continuously rising milk yield, as a result energy deficit increases. This leads to a competitive situation between milk yield, fertility, and health of the dairy cow because these traits are linked with energy requirement.

The various blood metabolites are used to measure the energy balance (EB) status in dairy animals, which has been reported to be strongly correlated with energy balance (Konigsson *et al.,* 2000; Clark *et al.,* 2005) [10, 7]. However, analyses of these blood metabolites are only feasible on experimental farms. Therefore, there is interest in other traits, like BCS which could serve as indicators of energy balance and may subsequently be related to the production and fertility status of an animal.

Body condition score is one of those measures which is widely used in many species to assess body fat reserve and energy status of animals (Veerkamp *et al.,* 2001) [14]. The body weight of animal cannot provide a reliable estimate of the energy reserves, as the reserves vary about 40% in animals with same body weight which directly or indirectly affects the performance of dairy animal (Andrew *et al.*, 1994) [1]. To overcome this, Lowman *et al.* (1973) [11] introduced the body condition score system developed for feeding strategies of the animal in such a way that animal is neither too thin nor too obese (Samarutel *et al.,* 2006) [12]. Body condition is defined as the ratio of the amount of fat to the amount of non-fatty matter in the body of the living animal. Body conditions is a reflection of the fat reserves carried by the animal. The ability to estimate the body condition more accurately and relate it to milk and milk components production would help the farmers to increase the overall efficiency of feeding and management of dairy animals. So, it is essential to evaluate the body condition of dairy animals based on body conformation points to understand the present status and accordingly suggest the feeding and managemental practices for optimal performance in future.

The observations on body condition status of animal will help the manager to adopt corrective management measures, thus enabling to improve the production profile of an animal. Hence, body condition scoring may be used as an effective tool in this regard.

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The present study was taken up to develop a body condition score system for Murrah buffaloes at livestock farm of LUVAS so that the scale developed can be used to assess and improve the reproduction and production status of buffaloes.

Materials and Method
This study was carried out at the Buffalo farm of Department of Livestock Production Management, College of Veterinary Sciences, the Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar. For this study thirty lactating Murrah buffaloes were selected according to their BCS two months prior to their expected date of calving

All the lactating buffaloes in the present study were housed in loose houses. T Asbestos sheet roofing with "*Typha-Typha*" (*Patera*) grass insulation was also provided over the covered area. Water sprinkler were provided to ameliorate the heat stress and manger guard to prevent wastage of green fodder. Concrete waterer were provided in the open area along with tree shade. As per the norms of the loose housing system, shallow drainage passage was provided in between the covered area and open area keeping in mind all standards slopes essential for proper drainage. Milking of the lactating buffaloes was being done twice a day in separate milking parlor as per the routine management practice.

As per the practice, balanced concentrate mixture is prepared with cereals, cakes, byproduct, mineral mixture and salt according to the BIS (1992) [3] standards. Concentrate mixture was provided twice daily also during day time around 9-10 am. Seasonal green was chaffed and offered twice during working hours. *Adlib.* straw was provided. All standard managemental practices and biosecurity measures were followed throughout the experiment along with the general managememnt. Hand milking is being practiced twice a day.

The following parameters were studied during the experimental period

Body Condition Score
To assess the body condition of the animal with a fairly high accuracy, a simple technique called body condition scoring was developed, which was being used in many developed and some developing countries. In this study, buffaloes were scored by using 0.25 increments BCS chart developed by Anitha *et al.* (2011) [2]. For recording the body condition of the animals, the following points were taken into account:
1. Vertebral column (chine, loin, and rump) flesh covering at the spinous processes of these regions.
2. Spinous processes – their prominence and sharpness.
3. Tailhead region – the prominence of depression between backbone and pins and between pin and hook bones.
4. Ribs and their flesh covering.

The experimental animals under investigation were body condition scored on a monthly interval till the end of the experiment.

Body Weight
The body weight of each animal was recorded in the morning

before providing the animals with any feedingstuff or water. The animals were weighed on 1000 kg capacity weighing balance fitted in the weighing platform.

Height at wither and height at chest from ground
The measurements were recorded with help of a scale. The height was measured when the animal was in a standing position evenly on the ground with normal posture. The fork of the instrument was placed perpendicular to the top of withers. The reading was taken from the ground to the highest level of withers. With the help of adjustable fork elevation on the rectangular vertical scale, height was measured in centimeters. Height at chest was measured between the distance of ground and dorsal side behind foreleg of the animal, with the help of measuring scale in cm.

Chest girth and abdominal girth
Chest girth measurements were recorded with the cotton made measuring tape. The measuring tape was encircled entirely around the chest region just behind the forelegs. The reading was taken when the animal was standing tall without any stretching and faulty position and body circumference measured immediately posterior to shoulder behind the elbow. Similarly, for abdominal girth, circumference was measured around the belly in front of flank and both the measurements were taken in cm.

Results
Body condition score (BCS)
The means of month wise comparison of BCS of murrah in different BCS groups have been presented in Table 1. The initial body condition scores of murrah under the BCS groups L, M, and H were averaged 2.58±0.05, 3.41±0.07 and 4.10±0.08, respectively two months before calving, however, the differences among the groups for the prepartum period were significant ($P<0.05$) thus indicating a presence of initial variation among the groups. The differences among the groups for all the prepartum period differed significantly ($P<0.05$). The results in the present study indicate that the BC scores of murrah buffaloes under all the three BCS groups showed an increasing trend from initial prepartum experimental period to calving. Thus clearly showing that the buffaloes all three groups gained some considerable condition during the prepartum period.

Body condition score during the postpartum period of buffaloes under different BCS groups L, M and H during the first month of postpartum experimental period averaged 2.25±0.06, 3.24±0.08 and 3.38±0.07, respectively. The corresponding means at the end of the experimental period i.e., 24 weeks postpartum were 2.67±0.05, 3.45±0.10and 3.98±0.04, respectively. The comparisons of the group mean revealed significant differences at all the postpartum months which appear to be due to the presence of dominant variations of body condition scores in different BCS groups at the time of parturition.

Table 1: Monthwise changes in body condition scores of Murrah buffaloes in different BCS groups.

Months	BCS Group L	BCS Group M	BCS Group H
2 months prior to calving	2.58[a]±0.05	3.41[b]±0.07	4.10[c]±0.08
1 month after calving	2.25[a]±0.06	3.24[b]±0.08	3.38[b]±0.07
6 months after calving	2.67[a]±0.05	3.45[b]±0.10	3.98[c]±0.04

Means with different superscripts row-wise differ significantly ($P<0.05$).

The body measurements such as the heart girth (HG), abdominal girth (AG), height at withers (HW) and height at the chest (HC) of all the experimental buffaloes belonging to the different body condition groups were compared under respective heads:

Monthwise changes in Heart girth (HG) of Murrah buffaloes in different BCS groups

The least squares means of HG measurements of buffaloes under respective BCS groups have been presented in Table 2. Mean of initial HG measurement two months before the calving under BCS groups L, M and H was 196.50±1.98 cm, 205.86±0.91 cm and 217.40±1.81 cm, respectively and showed a higher HG measurement in BCS group H followed by BCS group M and L. All the groups showed a marginal increase in HG in the prepartum period. The overall HG measurement during prepartum experiment period differed significantly ($P<0.05$) between BCS group L, M and H. The trends observed in HG measurements of buffaloes indicate a strong relationship with body weight and body condition score. Mean HG of buffaloes one month after the calving in BCS groups L, M and H were 192.33±5.38, 198.14±1.15 and 210.30±1.59 cm, respectively and the differences were significant between L and M, L and H. The respective HG measurements corresponding to the BCS groups L, M and H at the end of the experiment averaged 197.83±3.97, 202.57±1.11, 213.70±1.64 cm, respectively (Table 2). The comparison of overall HG indicated significant ($P<0.05$) differences between BCS group L and groups M and H.

Monthwise changes in Abdominal girth (AG) of Murrah buffaloes in different BCS groups

The least squares means of AG measurements of buffaloes under respective BCS groups have been presented in Table 2. Mean of initial AG measurement two Months prior to calving under BCS groups L, M and H was 224.33±1.76, 235.57±1.72 and 251.90±1.46cm, respectively and showed a significantely ($P<0.05$) higher AG measurement in BCS group H followed by BCS group M and L. All the groups showed a little increase in AG in the prepartum period. The overall AG measurement during prepartum experiment period differed significantly ($P<0.05$) between BCS group L, M and H. The trends observed in AG measurements of buffaloes indicate a strong relationship with body weight and body condition score. Mean AG of buffaloes one month after the calving in BCS groups L, M and H was 209.33±2.46, 218.21±2.25 and 235.20±0.93 cm and the differences were significant among the groups. The respective AG measurements corresponding to the BCS groups L, M and H at the end of the experimental

period averaged 217.83±2.07, 226.86±2.10, 243.70±1.05 cm, respectively (Table 2). The comparison of overall AG indicated significant ($P<0.05$) differences between BCS group H and groups M and L. The trend observed in AG measurements of murrah buffaloes suggests a direct relationship with body weight and body condition scores.

Monthwise changes in Height at withers (HW) of murrah buffaloes in different BCS groups

The least squares means of HW measurements of buffaloes under respective BC groups have been presented in Table. 2. Mean of initial HW measurement of buffaloes under BCS groups L, M and H were 129.67±0.42, 133.43±0.34 and 138.70±0.91 cm, respectively and showed a significantly ($P<0.05$) higher HW measurement in BCS group H followed by M and L. All the groups showed a little increase in HW in the prepartum period. The overall HW measurement during prepartum experiment period differed significantly ($P<0.05$) between BCS group H and L. The trends observed in HW measurements of buffaloes indicate a strong relationship with body weight and body condition score. Mean HW of buffaloes one month after the calving in BCS groups L, M and H were 130.83±0.48, 134.50±0.48 and 140.40±1.02 cm and the differences are significant among the groups. The HW measurements in BCS group H showed gradual fall over the experimental period. The respective HW measurements corresponding to the BCS groups L, M and H at the end of the experimental period averaged 130.17±0.40, 133.71±0.54, 139.20±1.02 cm, respectively (Table 5). The comparison of overall HW indicated significant ($P<0.05$) differences between BCS group H and groups M and L.

Monthwise changes in Height at the chest (HC) of Murrah buffaloes in different BCS groups

The least squares means of HC measurements of buffaloes under respective BCS groups have been presented in Table 6. Mean of initial HC measurement of buffaloes under BCS groups L, M and H were 58.50±0.43 cm, 55.21±0.35 cm, and 51.60±0.48 cm, respectively and showed a higher HC measurement in BCS group L followed by group M and H which differed significantly ($P<0.05$). Mean HC of buffaloes one month after the calving in BCS groups L, M and H were 59.17±0.54 cm, 56.29±0.35 cm and 52.90±0.59cm and the differences were significant among the groups. The respective HC measurements corresponding to the BCS groups L, M and H at the end of the experimental period averaged 58.67±0.84, 55.86±0.36 and 52.10±0.64 cm, respectively (Table 6). The comparison of overall HC indicated significant ($P<0.05$) differences between BCS group H and groups M and L.

Table 2: Monthwise changes in body measurements of murrah buffaloes in different BCS groups.

Months	BCS Group L	BCS Group M	BCS Group H
Heart Girth			
2 months prior to calving	196.50[a]±1.98	205.86[b]±0.91	217.40[c]±1.81
1 month after calving	192.33[a] ±5.38	198.14[b]±1.15	210.30[b]±1.59
6 months after calving	197.83[a]±3.97	202.57[b]±1.11	213.70[b]±1.64
Abdominal Girth			
2 months prior to calving	224.33[a]±1.76	235.57[b]±1.72	251.90[c]±1.46
1 month after calving	209.33[a]±2.46	218.21[b]±2.25	235.20[c]±0.93
6 months after calving	217.83[a]±2.07	226.86[b]±2.10	243.70[c]±1.05
Height at Weither			
2 months prior to calving	129.67[a]±0.42	133.43[b]±0.34	138.70[c]±0.91
1 month after calving	130.83[a]±0.48	134.50[b]±0.48	140.40[c]±1.02
6 months after calving	130.17[a]±0.40	133.71[b]±0.54	139.20[c]±1.02
Height at Chest			

2 months prior to calving	58.50^c±0.43	55.21^b±0.35	51.60^a±0.48
1 month after calving	59.17^c±0.54	56.29^b±0.35	52.90^a±0.59
6 months after calving	58.67^c±0.84	55.86^b±0.36	52.10^a±0.64

Means with different superscripts row-wise differ significantly ($P<0.05$).

Correlation between BCS and various body measurements

The correlation coefficient between body condition score and various body measurements are presented in Table 3. The results revealed a positive correlation between BCS with HG, AG and HW while a negative non significant correlation with HC.

Table 3: Coefficients of correlation of various body measurements with BCS

Traits	BCS group L	BCS group M	BCS group H
Heart Girth	0.064	0.655**	0.344**
Abdominal Girth	0.434**	0.684**	0.661**
Height at Wither	0.162	0.180	0.172
Height at Chest	-0.123	-0.144	-0.143

**Correlation is significant at the 0.01 level.
*Correlation is significant at the 0.05 level.

Discussion

Body Condition Score

The result of the present study indicated that the BCS of animal decreased in postpartum period in all the groups and a significant difference was found in body condition scores throughout the study period in prepartum as well as in the postpartum period. The results of the present study were in agreement with the Rao and Anitha *et al.* (2011) [2] they observed a decline in the BCS during the postpartum period in Murrah buffaloes. Similarly, Banos *et al.* (2004) [4] observed a decline in BCS during the starting 2 to 3 months of lactation followed by further an improvement in body condition score. Findings of this study were also in agreement with Banuvalli *et al.* (2014) [5] who reported that the loss of body condition is more in first two months of lactation for those animals which calved at high body condition score. As the earlier studies suggested that the nutrients obtained through the ration is insufficient for lactation during the first 90 day period of lactation, body reserves are used to attempt to meet the necessary energy requirement for milk production. The findings of this study are in agreement with the findings of Ferguson *et al.* (1994) [9], who reported that the body condition loss in the first two months of the lactation period in the animals with higher milk yield. Berry *et al.* (2003) [6] reported that cows selected for higher milk yield mobilized more lipid reserves than the cows which were low yielders. Thus, compromise on her body condition is more in high producers than lower ones. Markusfeld *et al.* (1997) and Samarutel *et al.* (2006) [12], also reported similar findings. In another study Dechow *et al.* (2002) [8], reported a significant positive phenotypic correlation between the BCS at calving and body condition loss after calving. In other words we can say that the condition loss increase with the increase in BCS at calving.

These findings are in support of the hypothesis that the higher level of body fat at calving has a negative feedback effect on feed intake after calving, so buffaloes that calved in higher condition score could not increase feed intake sufficiently to meet energy requirements for milk production, so it can be concluded that they had to lost a certain amount of body fat reserve to meet out the energy requirements for milk production. In this regard it is suggested to conduct more studies clarify the source of loss in body condititon score whether it is low feed consumption or higher energy requirements for milk production.

Relationship of BCS with various Body Measurements

The results of this study showed that the body measurement (HW, HC, AG, HG) differs significantly among the different BCS groups i.e. highest value exhibited by the animals in BCS group H as compared to group M and L in terms of AG, HG and HW while the HC found to be highest in the group L this might happen due the less fat deposition in the animals of BCS group L. Results of correlation study showed a positive relationship between BCS and AG, HG and HW and a negative correlation with HC.

The results of this study are in agreement with the study of Wildman *et al.* (1982) [15] who reported the correlation coefficients (r) for BCS i.e. with wither height (.04), with sternum height (-.15 * *) and with hook height (.08*) in his study.

Reference

1. Andrew SM, Waldo DR, Erdman RA. Direct analysis of body composition of dairy cows at three physiological stages. J Dairy Science. 1994; 77:3022-3033.
2. Anitha A, Sarjan Rao K, Suresh J, Srivasa Moorthy PR, Kotilinga Reddy Y. A body condition score (BCS) system in Murrah buffaloes. Buffalo bulletin. 2011; 30:79-99.
3. BIS. Basic Animal Husbandry Statistics. Department of Animal Husbandry, Dairy and Fishries, Government of India, 1992.
4. Banos G, Brotherstone S, Coffey MC. Evaluation of Body Condition score measured throughout lactation as an indicator of fertility in dairy cattle. J Dairy Sci. 2004; 87:2669-2676.
5. Banuvalli N, Bhaskaran R, Krishnamurthy U, Gurraj PM, Kumar H, Ramesh HS. Effect of Body Condition Score at parturition on post-partum productive and reproductive performance in cross breed dairy Cows. International J Livestock Res. 2014; 4(8):5-11.
6. Berry DP, Buckley F, Dillon P, Evens RD, Rath M, Verkamp RF. Genetic relationships among body condition score, body weight, milk yield and fertility in dairy cows. J Dairy Sci. 2003; 86:2193-2204.
7. Clark CEF, Fulkerson WJ, Nandra KS, Barchia I, Macmillan KL. The use of indicators to assess the degree of mobilization of body reserves in dairy cows in early lactation on a pasture-based diet. Livestock Prod. Sci. 2005; 94:199-211.
8. Dechow CD, Rogers GW, Clay JS. Hertability and correlations among body condition score loss, body condition score, production and reproductive performance. J Dairy Sci. 2002; 85:3062-3070.
9. Ferguson JD, Galligan TD, Thomsen N. Principal descriptors of body condition score in Holstein cows. J. Dairy Sci. 1994; 77:2695-2703.
10. Konigsson K, Savoini G, Govoni N, Invernizzi G, Prandi A, Kindahl H *et al*. Energy balance, leptin, NEFA and IGF-I plasma concentrations and resumption of postpartums ovarian activity in swedish red and white breed cows. Acta Veterinaria Scandinavica. 2000; 50(3):1-7

11. Lowman BG, Scott N, Somerville S. Condition scoring of cattle. East of Scotland College of Agriculture, Bulletin No. 6, Edinburgh, UK, 1973.

12. Samarutel J, Ling K, Jaakson H, Kaart T, Kart O. Effect of body condition score at parturition on the production performance, fertility and culling in primiparous Estonian Holstein cows. Vet. J Zootechnika. 2006; 36(58):69-74.

13. Snedecor GW, Cochran WG. Statistical Methods. 8th ed. Iowa State University Press, Ames, Iowa, 1994.

14. Veerkamp RF, Koenen EPC, DeJong G. Genetic correlations among Body condition score, yield, and fertility in 1st parity cows estimated by random regression models. J Dairy Sci. 2001; 84:2327-2335.

15. Wildman EE, Jones GM, Boman PE, Troutt RL, Lesch TN. A dairy cow body condition scoring system and its relationship to selected production characteristics. J Dairy Sci. 1982; 65:495-501.